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MOSQUITO CONTROL

A Larvicide Programme for Spring Species:

Orillia 1974

SB
945
.M75
M15
1974

Ontario
Ministry of the Environment

The Honourable
Harry C. Parrott, D.D.S.,
Minister

Graham W. S. Scott, Q.C.,
Deputy Minister

SB
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MOSQUITO CONTROL

A LARVICIDE PROGRAMME

FOR SPRING SPECIES

ORILLIA - 1974

PREPARED BY:

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Environment

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D. L. MacKenzie

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ABSTRACT

Reduction of biting incidence by a nuisance mosquito population has been found to be possible through many types of techniques: habitat alteration (land drainage and vegetation clearance), adult trapping (with electrical or light apparatus), personal protection measures and pesticide application (adulticiding, larviciding or a combination of both). The approach investigated and discussed in this report is ground application of a larvicide (Abate) which was carried out within the boundaries of a small municipality in the spring of 1974. Careful planning and training of responsible, interested personnel resulted in a very successful control programme of the spring Aedes mosquito population. In addition, benefits could be seen in terms of cost and manpower when compared with previous, less exacting techniques. It is hoped that this documentation of the approach and procedure will serve as a guideline to other municipalities or groups interested in this type of endeavour for mosquito abatement.

INTRODUCTION:

In Ontario mosquitoes have been a source of discomfort to many residents during the spring and summer months. Demand for control of these pests is increasing public awareness of the problem and possible methods of control.

While it is impossible to eradicate mosquitoes, it is possible under certain circumstances to reduce their numbers to acceptable levels. This varies with the nuisance species present, available breeding habitat within and adjacent

to the proposed area of control, physiography of the region and annual climatic conditions. As outlined in "Controlling Mosquitoes and Black Flies in Ontario", (Appendix X) the Aedes genus of mosquitoes in the province are the greatest source of human irritation. Spring species (i.e. Aedes stimulans, A. implacatus, A. punctor, A. canadensis, A. trichurus, A. cinereus, A. communis) exhibit similar life cycle patterns: eggs develop in woodland pools at the onset of snow-melt usually early mid-April and hatch into larvae. The larvae grow and molt three times into progressively larger stages. Each stage of growth is called an instar; after the fourth instar the larvae develop into pupae usually early to mid-May. Adults emerge mid- to late May; biting incidence will peak mid- to late June and decrease significantly by mid -July as adults die. Eggs laid by this generation will remain dormant until the following spring.

Summer Aedes (A. vexans, A. sticticus, A. fitchii) overwinter as eggs which develop in the presence of warm flood water after temporary drying. The first generation larvae are not generally abundant until late May or early June but warm temperatures will increase the rate of development and the complete life cycle may occur within a two week period. Eggs laid by the first generation may or may not hatch later the same summer. Thus, two, three, four or even five generations may occur over one summer season following a spaced series of heavy rains. A typical breeding site of this group is a grassy pool adjacent to a highway intersection or cloverleaf, or depression in a golf fairway where rainfall will collect for seven to ten days. Permanent

waters such as lakes, ponds and cattail swamps are not usually a source of Aedes mosquitoes, unless water levels fluctuate frequently.

Pesticides recommended for mosquito control may be either adulticides or larvicides. An adulticide is generally applied as a surface residual spray on vegetation or as a space spray (fog or ULV - ultra low volume spray); an adequate period of contact of the pesticide with the adult insect is necessary to kill the pest. A larvicide is applied directly to water to kill the insect before it reaches the pupal stage of the life cycle; it may be an effective method of control if all breeding sites are treated and invasion of adults from adjacent unaltered habitat is not significant. Pesticide recommendations for mosquito control are revised annually and published in "Controlling Mosquitoes and Black Flies in Ontario". (Appendix X)

After consideration of the physiography of the area and target species, a pilot project was instituted in 1974 in the City of Orillia to implement a mosquito abatement programme utilizing a larvicide for control of the spring Aedes population. This report was prepared to document their procedure and serve as a guideline for other municipalities intending to implement similar mosquito control programmes.

(1) HISTORY:

In the past the City of Orillia had tried various methods to reduce biting incidence by mosquitoes in the area, with little success. The last method tried, in the spring of 1973, was a large scale application of Abate 5C capsules to all standing water within the city. When this approach failed

because of inadequate knowledge of target mosquito species, the Ministry of the Environment was contacted for assistance. They proceeded to plan with the Ministry guidance to execute a programme for control of the spring Aedes population.

(2) EDUCATION, TRAINING AND LICENSING:

Use of any control method (chemical, mechanical or biological) in water should be considered in light of the following criteria:

(1) What is the problem (pest, location, identification)?

(2) Who or what will be affected?

(3) What are the effective methods of control?

(4) Are there adverse environmental effects?

To safely and effectively control a nuisance pest, it is essential to understand the ecology of that pest species. When a pesticide is the means of control, the pest's life cycle, as it relates to optimum time of chemical application is particularly important.

The goal of the Pesticides Control Section is to promote the safe use and sound management of pesticides in Ontario. Regulations under the Pesticides Act, 1973 have been designed to achieve this goal while meeting the above criteria.

Where a situation indicates that use of a pesticide may be feasible, safe and effective, an individual or company must obtain an operator's licence to carry out the programme. In compliance with the Act and Regulations, the operator will be required to meet several requirements including adequate liability insurance. He also must obtain an appropriate

exterminator's licence, which is required for his supervision of staff who will actually be implementing the treatment.

With respect to the City of Orillia, the decision was reached that mosquito control would most effectively be achieved through use of a larvicide. Since the pesticide is applied directly to water which may transport some of the material through surface run-off into public water courses, an aquatic nuisance control permit was also required.

A licence and permit do not relieve the individual of the responsibility for improper use but seeks to minimize the risk of errors which might make the pesticide use hazardous to other human life or to the environment. To assist the City of Orillia to meet the legislative requirements, training and tutorial sessions were organized by the Pesticides Control Section (mid-March to early April) followed by written and oral examinations. Such aspects as equipment calibration, mapping of mosquito breeding sites, monitoring for presence of mosquito larvae, time and method of pesticide application, evaluation techniques and data collecting were discussed.

In compliance with permit requirements, (since the exact size of the total treatment area and hence the total quantity of larvicide authorized could not be stipulated beforehand) a conditional permit (see Appendix I) was given consideration and issued. A condition under this permit required submission of all pertinent details of the pesticide application at the end of the season. This proved satisfactory for all concerned.

To obtain a permit, application forms must be completed in duplicate and submitted for consideration at least three weeks prior to commencement of the proposed treatment. Effective 1975, the application form and permit have been incorporated into one document. A sample copy has been appended as Appendix II.

(3) FIELD MAPPING AND MONITORING OF BREEDING SITES:

Data on potential breeding areas was collected from past experience and knowledge of the terrain. This was documented over the winter on a city map marked on a grid scale (see Appendix III); updating of this information commenced immediately upon snow-melt (early April). Public works staff of the City of Orillia systematically inspected the areas within each section of the map, mapping, numbering and logging dimensions of the pools found to contain mosquito larvae. This larval sampling was carried out during the last three weeks of April. A log book containing a blow-up of each map section which was assigned a letter of the alphabet (see Appendix IV), and a data sheet on each numbered pool (see Appendix V) was assembled into a loose-leaf binder and carried in the field so that subsequent changes could be noted (e.g. where house construction and landfilling had reduced available habitat). A description of each pool was also made so that habitat type could be correlated with species of larvae present and time of monitoring. Sampling enabled staff to discern infested pools from non-problem water areas. Thus, the subsequent treatment covered only 190 acres rather than the original 620 acres of temporary water proposed for control.

Larval sampling was achieved through use of a white enamel water dipper (4 inch mouth diameter). The container was dipped into the water near grass tufts around pool edges at an angle so that water containing larvae would flow into the dipper with minimal disturbance of the pool. The contents were then studied for number and stage of growth of mosquito larvae and the count noted in the log book. Care was taken to avoid creating shadows over the water areas to be dipped. Physical movement in handling the dipper were slowed to avoid scaring the larvae. The number and location of dips taken in any one area depended upon the size, depth and configuration of the pool, and varied with findings in the first few dips. In some cases where access to pools was difficult, sampling was done using a dipper with an elongated handle. A number of references are available on dipping frequency and significance of larvae numbers per dip. Orillia used the guideline suggested by an entomologist with the Canada Department of Agriculture: where 25 to 30 larvae are found per dip, there is need for control.

It was important in conjunction with sampling for numbers to determine what species of mosquitoes were being monitored, since not all species of mosquitoes (even within the genus of Aedes) are nuisance problems which should be controlled (see Appendix VI). Therefore an entomologist with the University of Guelph, assisted us in identifying species found. A variety of types and sizes of pools were selected and mosquito instars were collected and taken alive to the University laboratory for closer study. Identification is

difficult unless the larvae have fully developed. The findings of April 18, 1975 correlated with map location and pool type was as follows:

Section K - Pools # 1 & 3 (marshy area):

Aedes trichurus
A. punctor
A. cinereus

Section L - Pool # 6 (leaf debris, elm, oak, & maple woodland pool):

Aedes stimulans
A. trichurus

Section L - Pool # 36 (grassy pool near railway line):

A. trichurus

Section F - Pool # 43 (swamp city landfill site):

A. stimulans
A. excrucians
A. fitchii

No larvae were found at the time of inspection in some areas i.e. the bog around Victoria Crescent which had been highly suspect as a major breeding site. Some green grassy areas rapidly drying up at that time were not sources of spring *Aedes* species but would have to be monitored after heavy rains for production of summer *Aedes* species (i.e. *A. vexans*).

All species identified by the university entomologist were nuisance biters of humans from late May through early July. These pools and others containing larvae were earmarked for control. Pools found to contain larvae of the *Culex* or *Culiseta* genera need not be treated. Once all the areas had been checked, monitoring of size and number of instars

per dip commenced. When field data indicated that a significant proportion of the larvae population was in the second and third instar, application of the larvicide started. In Orillia, in 1974, these stages developed about May 1. Since a thorough treatment required some time, allowance had to be made, and therefore some larvae were treated at younger than the third and fourth instar. Larvae of spring mosquito species develop completely in two to three weeks depending upon water temperature and availability of food; therefore numbers and stage of development had to be closely monitored and the treatment plan well prepared in advance for rapid execution: equipment calibration, task assignment, staff familiarization with procedure and all anticipated problems resolved.

(4) SELECTION OF MANPOWER AND MATERIALS

Implementation of a successful larvicide programme relies, to a very great extent, on conscientious workers. Thus staff for this programme were selected from the Public Works Department, City of Orillia, on the basis of their interest, reliability, and permanency. The latter is important in terms of continuance of an effective method for more than one year, since with proper training and experience less outside assistance and supervision would be required in similar future endeavours. For the scale of programme proposed by the City, one supervisor and four staff were recruited and trained.

Recommendations for controlling mosquito larvae are published annually in the booklet, "Controlling Mosquitoes and

Black Flies in Ontario", published jointly by the Ontario Ministries of the Environment and Natural Resources, (Appendix X). Abate 5C capsules were no longer available in quantity and their performance in heavily vegetated interlocking pools of irregular shapes was variable (as was demonstrated by their use in Orillia in 1973). The City of Orillia chose Abate emulsifiable concentrate and granular formulations. Two formulations were selected to permit staff to compare handling and efficacy in the field. Using the size of the proposed treatment and mean rate of application, approximate total quantities of materials were calculated (2 gallons of liquid Abate 4E and 400 pounds of granular Abate 2G - M78 mesh size) and purchased early in the season. They were stored in compliance with safe handling practices (as in the Ontario Regulation 618/74 sections 98 and 99) until used. Also, application equipment and safety equipment such as coveralls, boots, gloves, goggles and respirators should be purchased at this time. For safety equipment specification observe label requirements and common sense.

(5) CALIBRATION OF EQUIPMENT TO MEET RECOMMENDED APPLICATION RATES

Two types of ground equipment were selected: rotary seeder spreaders and galvanized back-pack sprayers. Application of a pesticide with either the granular spreader or sprayer is subject to inherent human error since both are people-ported machines. A standard error of 25% is not uncommon in either instance.

Calibration was easiest with the granular spreaders. The opening adjacent to the rotating disc was adjusted to allow application of four pounds granular formulation of Abate over one acre of water, at an individual's normal walking speed and regular cranking of the handle. This was first done on a smaller pre-measured area (perferably dry black pavement) and output measured accordingly. Observation of the spacing of granules per unit area was made and used as a guideline for the field to ensure correct dosage was made to small irregular pools. Since the granules could be easily identified in the pools, this formulation was preferred over the liquid. Four pounds product/acre was used as a median so that errors in the field (approximately $\pm$ 25%) would still be within the recommended application range of 3-5 pounds product per acre.

People vary greatly in their average walking speed, measure of endurance and application behaviour (caution, re-treatment of areas, etc.). As well, each piece of equipment varies slightly in performance. Therefore, a seeder or back-pack sprayer was assigned to a specific individual for use and maintenance. Record of the treatment (Appendix V) noted the name of the applicator, quantity of chemical used per area of water, formulation used and date of treatment to gauge efficacy of treatment over time and human experience. Wear on the seeders was extensive; they will have to be replaced next year. The replacement of granular spreaders will vary with use; inspection should be made particularly when a unit has been used to apply 150 - 200 pounds of material.

Use of back-pack sprayers also presented problems. Calibration was difficult because of the large variability in spray output according to the user. As with the granular spreaders, each sprayer should be calibrated by the individual assigned to that piece of equipment. In trials using only water, one sprayer was found to put out 4-5 fluid ounces in 10 seconds and the second 6 fluid ounces in 10 seconds, even though they were identical in size, make, and year. An average discharge of 0.5 fluid ounces per second was used. Orillia calculated the quantity of chemical added to the sprayer to be 3/4 fluid ounces of Abate 4E product mixed with 320 fluid ounces of water based on an average walking speed of 3 to 6 m.p.h. (5-10 ft/sec). (In the sprayer which discharged 0.6 fluid ounces per second, a little less than 3/4 fluid ounces product per tank was used). The rate of chemical application of Abate depends not only on rate of walking, but on height of the nozzle above the ground which affects swath width.

Guidelines suggested by the Canada Department of Agriculture, have been included in the Appendix VII to assist those calibrating and using back-pack sprayers. Since the type of nozzle and the wear on the nozzle with use will greatly affect the spray pattern, checks should be made periodically that application is uniform and consistent over time. Worn nozzles should be replaced when necessary. The following table illustrates the variation in Abate application with walking speed and nozzle height (i.e. swath width).

When the back-pack sprayer contains 3/4 fl.oz. Abate in 320 fluid ounces of water, discharge is 5 fl.oz. material/10 seconds.

Walking Speed (m.p.h.)	ft/sec	Swath Width (feet)	Area Covered in 10 Seconds (acres)	Rate of Application fl. oz. Abate/acre
1.5	2.5	1	.0006	19.67
1.5	2.5	2.5	.0015	7.87
1.5	2.5	5.0	.0029	4.07
1.5	2.5	10	.0058	2.03
3	5	1	.0012	9.83
3	5	2.5	.0029	4.07
3	5	5	.0058	2.03
3	5	10	.0116	1.02 *
6	10	1	.0023	5.13
6	10	2.5	.0058	2.03
6	10	5	.0115	1.03 *
6	10	10	.0230	.51 *

* Note that only these figures fall within the recommended registered rate of application: 0.5 - 1.5 fl.oz. product/ acre.

(6) ACTUAL TREATMENT

Since the optimum time to apply Abate occurs when the majority of the mosquito larvae are in the third instar, halfway through the larval growth stage, the time of initiating treatment depends greatly on the local conditions that year. Monitoring for stage of larval development began in mid-April on a frequency of every two days and conditions developed to the state where some third instar, but mostly second instar were evident by May 1. Since one treatment over the entire spring breeding territory was determined by manpower and rate of coverage to be approximately ten days to two

weeks and since third instar larvae would mature into pupae in that time span, treatment was implemented May 1. Pools containing the oldest larvae in greatest numbers were treated first. A history of treatment was maintained on each numbered pool or series of pools (see Appendix V) and each treated site was visited within four days (optimally 24-48 hours) to establish kill and re-treat where necessary. Each exterminator maintained his own records on the performance of a piece of equipment and application so that if problems developed, the source of error could be properly identified. Infrequent and intense monitoring of each pool was correlated with atmospheric weather conditions to monitor possible changes in the rate of maturation of the larvae (acceleration due to extremely warm weather conditions) triggering earlier treatment.

Four individuals operating two rotary spreaders (with granular formulation) and two back-pack sprayers treated approximately 190 acres. This was significantly lower than the original proposal of February 1974 of 620 acres (compare Appendix III and VIII). Small individual pools were tagged where treatment was undertaken; prospector tape was useful for this. In extensive areas, the four men would travel abreast; spray bombs were used to delineate band widths to reduce duplicate spraying. The granular formulation of larvicide was preferred by the field crew to the liquid because the insecticide distribution and uniformity of application was easily observed. Fresh water and vials with pre-measured quantities of liquid Abate 4E were carried in the field for on-site refills of the back-pack sprayers.

Spring species of mosquitoes were controlled by treatment commencing May 1 and terminating May 15th. Cost of the operations including licence and training, equipment, salaries for four men, and chemical purchase of 400 pounds of Abate 2G (mesh 78) and 2 gallons of Abate 4E and safety equipment totalled $4,400. This compared favourable with the total expenditure of $3,803 in 1973 where 24,000 Abate 5C capsules were obtained ($3,200 of this was for purchase of the capsules) and unsatisfactory control was achieved.

In an initial programme, it is almost impossible to estimate actual expenditures, since the scope of the problem and treatment requirements are largely unknown.

(7) EFFICACY

Results of a larvicide programme can be determined in several ways:

1. Immediate follow-up where sampling is conducted to determine larvae kill. (The City of Orillia used this method).
2. Long-term follow-up where a biting incidence count or adult trapping programme (white light, beta-light, or carbon dioxide traps or combinations of these) is used to ascertain if there has been a significant reduction in the adult population. There is no general concensus among research entomologists with respect to the validity of adult trapping techniques. Interference from adult mosquitoes moving into the treated area from surrounding areas may add greatly to any determination of reduced population made by these techniques.

Orillia used the observation of treated pools as the parameter to determine efficacy. Inspection and sampling of various sites in mid-and late May with city personnel, verified that over 95% of the larvae of the spring species of mosquitoes were killed. Sampling of pools in early July, five days after a heavy rainfall produced many pupae cases of Aedes vexans, a summer species which can present a significant biting problem to man; over fifty cases per dip were found in shallow grassy pools adjacent to the main highway. Since monitoring and treatment of the summer species was not planned for 1974, this observation was noted as a future point of training only.

In terms of the opinion of local personnel implementing the programme and a public evaluation of its effectiveness by comparing 1974's biting problem with other years, this larvicide programme for spring mosquito species was successful (Appendix IX). Levels of adults remaining through the spring and summer were judged acceptable and no adulticiding was done.

(8) ABATE RESIDUES

In the application of a pesticide to the environment, the following aspects of pesticide impact are important to consider:

1. Was the pesticide applied at the recommended rate or was there an overdose resulting in an effective control?
2. Does the pesticide persist, and if so, does it move from the site of application?

3. Is there an effect on non-target organisms and, if so, is it long-term and significant? Is short-term alteration of the ecosystem significant in terms of the efficacy of the pesticide programme or is a trade-off acceptable?

Residue sampling was undertaken at three sites, selected for their different physiographic characteristics were: (a) Pool 13, (Section E), Grenville Street, (b) Pool 16, (Section E), and (c) the junction of Rogers Road and Forest Avenue (Section L) - see map (Appendix III). Samples of water and mud were obtained pre-treatment and triplicate samples of mud and water at each site immediately post-treatment May 1. Triplicate samples of mud and water were also collected from each site May 6th. Single samples of water and mud were also collected at the first two locations July 11th. Pesticide analysis was kindly performed by Dr. R. Frank and staff at the Provincial Pesticides Residue Testing Laboratory at Guelph.

Immediately post-treatment in May, Abate was detected in water at less than 3.5 parts per billion in two of the nine samples. In the other seven samples it was less than 0.5 parts per billion (below detectable limits). Abate was detected in the mud at less than 0.4 parts per million in only one sample; the other eight samples registered less than 0.02 parts per million (below detectable limits).

No residues were found in any of the material (mud or water) collected May 6, and none found in the July 11th submissions.

Samples of cattail plants were obtained pre- and post-treatment May 1 from pool # 13 to determine if Abate could be taken up by plant tissue. The lowest limit of detection (0.02 parts per million) was found in one of the three plants obtained immediately post-treatment; no residue was found in the tissue collected May 6 for analysis.

In summary, the residues found indicate that the recommended application rate of Abate was not exceeded and that the pesticide did not persist in the environment as a toxic residual more than 48 hours.

Sampling of invertebrates was also done pre- and post-treatment at each of the three sites, but difficulties in standardizing the sampling method with equipment available and variable preservation methods made analysis of the material and interpretation of the statistics difficult. Improvements in technique and methadology will make future sampling more informative.

(9) SUGGESTIONS FOR IMPROVEMENT OF THE PROGRAMME

As outlined in the City report (Appendix IX) not all of the mosquitoes were eradicated, but this was not the goal. In a practical field programme 100% control of a pest species is impossible. With respect to the aim of the 1974 programme at Orillia, this control programme was very successful.

Suggestions for further work in this area, now that current goals have been achieved, might be an expansion of the present aim to include:

1. Monitoring and control programmes designed toward

reduction of the summer Aedes population (particularly Aedes vexans) if observation indicates that this group also is a significant nuisance problem.

2. Monitoring of the adult mosquito population in late June (through adult trapping or biting incidence) to discern whether the pests were produced from untreated habitat within the controlled area, or whether adults were moving in from adjacent untreated breeding sites. This information would assist us in redefining the required scope of the programme.

(10) SUMMARY

In Orillia a successful control programme for spring species of mosquitoes was achieved in 1974 with use of Abate as a larvicide. A timetable for similar programmes is included for reference; implementation time is only approximate since weather conditions will greatly dominate the size, emergence, and persistence of a mosquito population in a particular year.

To ensure success, a municipality should:

(a) Define the target pest, understand its ecology and source (i.e. breeding sites).

(b) Define a feasible control programme, in light of desired control, availability of funds and capable staff.

(c) Enlist adequate competent personnel.

(d) Obtain suitable training, appropriate licences and permits when required.

(e) Apply the pesticide with care at the appropriate time and monitor the results.

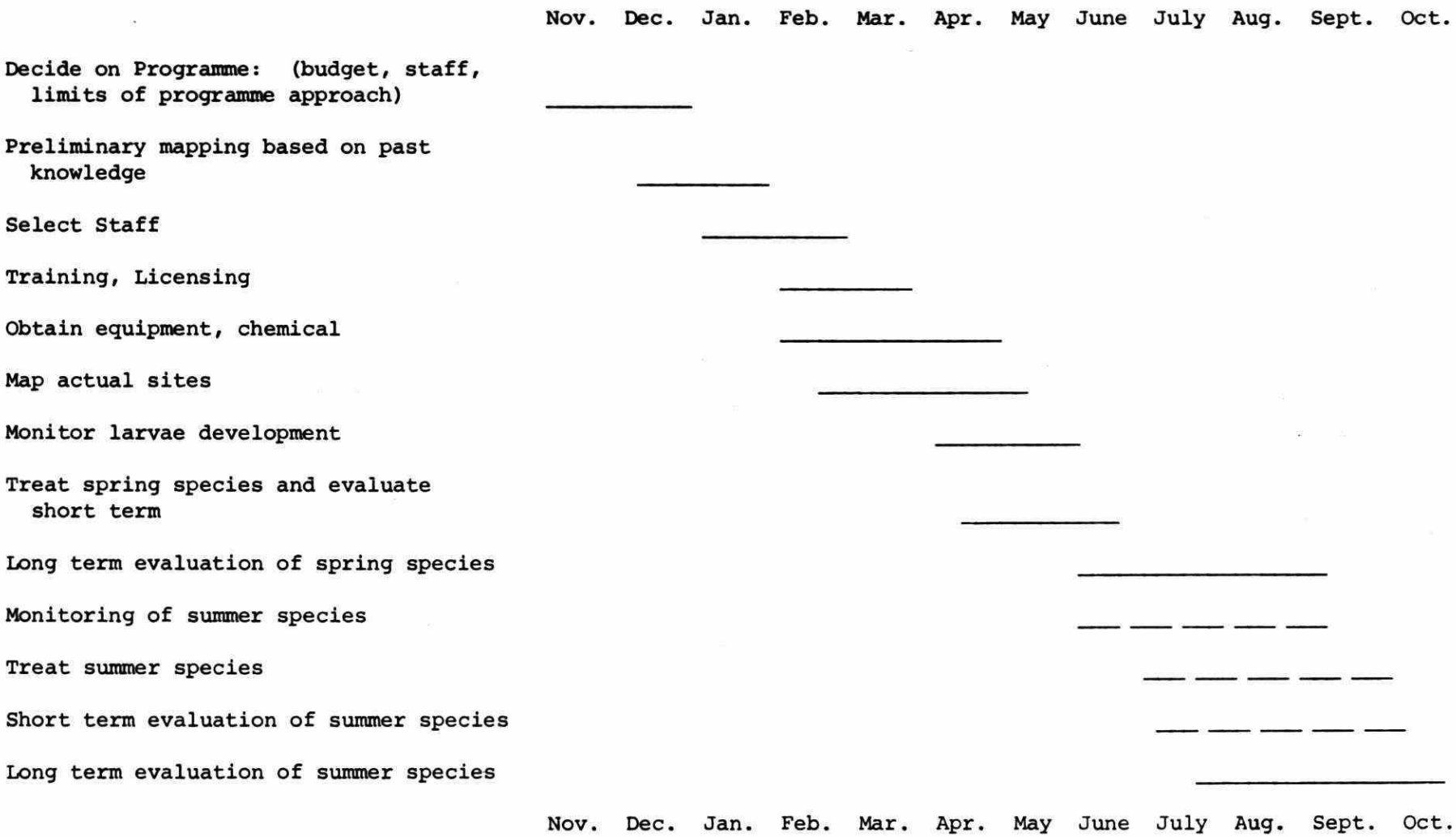
(f) Record all treatment details.

(g) Select a yardstick to determine the programme's success.

(h) Determine what factors should be further considered should results be less than satisfactory.

The Pesticides Control Section, Ministry of the Environment, is prepared to assist any municipality intent upon implementation of a similar abatement programme.

TIMETABLE FOR MOSQUITO LARVICIDE PROGRAMME *


Nov. Dec. Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct.
Decide on Programme: (budget, staff, limits of programme approach)
Preliminary mapping based on past knowledge
Select Staff
Training, Licensing
Obtain equipment, chemical
Map actual sites
Monitor larvae development
Treat spring species and evaluate short term
Long term evaluation of spring species
Monitoring of summer species
Treat summer species
Short term evaluation of summer species
Long term evaluation of summer species
Nov. Dec. Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct.

* Tentative Schedule dependent on weather, region, etc.

ONTARIO

APPENDIX I

NO. Huronia 20/73

PERMIT TO APPLY SUBSTANCES TO WATER FOR THE CONTROL OF AQUATIC NUISANCES

MINISTRY OF THE ENVIRONMENT

UNDER SECTION 38 OF THE ONTARIO WATER RESOURCES ACT, PERMISSION FOR THE APPLICATION OF SUBSTANCES TO WATER FOR THE CONTROL OF AQUATIC NUISANCES IS GRANTED TO:

NAME
City of Orillia Works Department

ADDRESS FOR ALL PURPOSES PERTAINING TO THE PERMIT
Box 7, ORILLIA, Ontario

THIS PERMIT IS GRANTED IN ACCORDANCE WITH THE FOLLOWING PARTICULARS TERMS AND CONDITIONS

NAME OF BODY OF WATER	TOWNSHIP
Swampy areas within the city boundaries	City of Orillia, Simcoe County
CONCESSION OR PLAN	LOT
-	-

DESCRIPTION OF AREA
Various locations throughout the city

AREA OF WATER TREATED NOT TO EXCEED
27,000,000 square feet or approximately 620 acres

TRADE OR CHEMICAL NAME OF SUBSTANCE(S) TO BE USED
Abate 4E liquid

TOTAL WEIGHT OR VOLUME OR SUBSTANCE(S) TO BE USED	PERCENTAGE ACTIVE
To be determined at time of treatment based on the rate of 1 fluid oz. product per acre of water.	43 %

CONCENTRATION OF THE SUBSTANCE IN THE WATER AREA TO BE TREATED NOT TO EXCEED
Less than .05 pounds active per surface acre of water

PURPOSE OF APPLICATION(S) OF SUBSTANCE(S)
Control of mosquito larvae

DATE(S) OF APPLICATION(S)	NUMBER OF APPLICATIONS
May 1-15th/74 *	One *

SPECIAL TERMS AND CONDITIONS (NOTE: SEE GENERAL CONDITIONS ON REVERSE SIDE)

* Control of spring Aedes species will be conducted when the majority of larvae are present in 2nd and 3rd instar stages; quantity of chemical to be used and size of area to be treated will be determined at the exact time of treatment.

Control of summer Aedes (A. vexans) will be attempted throughout the summer whenever larvae are present in flood water pools.

In some areas use of the 2G granular formulation of Abate may be substituted. Application is to be made on the basis of 0.05 - 0.1 pounds active per acre.

Records of exact treatment procedures will be kept and personnel from the Ministry of Environment, Pesticides Control Section will assist in the evaluation of treatment success.

DATED AT TORONTO

THIS THE 26 DAY OF April 19 74.

K.H. Slayne

EXECUTIVE DIRECTOR, WATER RESOURCES
MINISTRY OF THE ENVIRONMENT

MOE 12 066/5/72

GENERAL CONDITIONS

1. The permittee, by acceptance and in consideration of the issuance of this permit, agrees to all of the particulars and terms and conditions thereof.

2. The permittee agrees:

   (i) To permit authorized representatives of the Ministry of the Environment or the Ministry of Natural Resources any time, for the purposes of this permit, to enter into the lands and buildings of the permittee or under his control and to make such surveys, examinations, investigations, inspections or other arrangements and to take away such samples, as the representatives deem necessary, and to furnish such facilities and assistance for the aforesaid purposes as may be required.

   (ii) To submit any information that may be required by the terms and conditions of this permit.

   (iii) To indemnify and save harmless Her Majesty the Queen in right of Ontario and Her officers, employees or agents from and against all liability, damage, loss, costs, claims, demands, expense, actions and proceedings, arising out of or connected with the permission hereby granted, or the use, enjoyment or exercise thereof by any person, or any act or omission of the permittee or of any of his agents or employees relating to any of the particulars, or of the terms and conditions of this permit.

   (iv) To keep this permit available at all times for inspection.

3. This permit does not release the permittee from any legal liability or obligation and remains in force subject to all limitations, requirements and liabilities imposed by law including any statute of Canada or the Province of Ontario. This permit shall not be construed as estopping or limiting any legal claims or rights of action that any person, including the Crown in right of Canada or the Province or any agency thereof, has or may have against the permittee, his agents or employees.

4. The application of the substance(s) authorized by this permit shall be made only by the permittee or under the permittee's control and supervision.

5. Subject to the particulars and the terms and conditions of this permit, the permittee shall apply the substance(s) authorized by this permit in accordance with the directions, if any, of authorized representatives of the Ministry of the Environment or of the Ministry of Natural Resources, and, when directed to do so, shall forthwith cease to apply such substance(s).

6. Except as otherwise specifically provided herein, where damage to or the death of fish is caused by the application of the substance(s).

7. When the Executive Director, Water Resources of the Ministry deems it necessary, this permit may be cancelled or the particulars and terms and conditions thereof may be altered at any time and without prior notice, for any of the following reasons:

   (i) The conservation of fish and wildlife resources.

   (ii) The protection of the public interest.

   (iii) Where the application of the substance(s) authorized by this permit may cause damage, injury or loss.

   (iv) The violation of any of the particulars or of the terms and conditions of this permit.

   (v) The supplying of false, misleading or incomplete information by the permittee, his agents or employees to the Executive Director, Water Resources of the Ministry or to the Ministry of Natural Resources.

SECTION 38 (4) OF THE ONTARIO WATER RESOURCES ACT PROVIDES THAT EVERY PERSON WHO CONTRAVENES ANY OF THE TERMS AND CONDITIONS OF A PERMIT ISSUED BY THE EXECUTIVE DIRECTOR, WATER RESOURCES OF THE MINISTRY, UNDER SECTION 38 (1) OF THE SAID ACT, IS GUILTY OF AN OFFENCE AND ON SUMMARY CONVICTION IS LIABLE TO A FINE OF NOT MORE THAN $500.

APPENDIX II

Ontario

Ministry of the Environment

Pesticides Control Section

The Pesticides Act, 1973

Form 7

Application for a Permit to perform a Water Extermination

PLEASE PRINT CLEARLY

I, ... TELEPHONE (HOME) ..... (BUS.) .....

(Print name of applicant who shall be the person responsible for the treatment. Where a commercial applicator will undertake the treatment, he shall be the applicant for the permit.)

of (home address) .....

(business address) .....

apply for a permit to apply pesticides to water in accordance with the following particulars:

1. Is the treatment to be undertaken by a commercial applicator? ☐ No – ☐ Yes

If "Yes", state your Exterminator's Licence Class ..... and Number .....

Operator's name ..... Licence Class ..... Number .....

Address .....

Particulars of the person for whom the applicator proposes to undertake the treatment:

Name ..... TELEPHONE (HOME) ..... (BUS.) .....

Address .....

2. Purpose of treatment is to control:

I	Algae:	☐ FILAMENTOUS,	☐ CHARA SP.
II	Submergents:	☐ TAPE GRASS,	☐ OTHER .....
III	Emergents:	☐ WATER LILIES,	☐ DUCKWEED, ☐ CATTAILS, ☐ OTHER .....
IV	Pest fish:	SPECIFY	
V	Insects:	SPECIFY	
IV	Other:	SPECIFY	

3. Location of area to be treated:

LOT	CONC.	TOWNSHIP	COUNTY OR MUNICIPALITY

Name of body of water for which treatment is proposed

NAME, IF APPLICABLE

4. Describe the area to be treated by providing a detailed map indicating:
   (a) the dimensions of the water area and sufficient depth measurements to allow the calculation of water volume; note location by reference to permanent reference points (buoys, docks, etc.);
   (b) the position and distance from treated area of any private or municipal water intakes;
   (c) the boundaries of properties fronting on or adjacent to the area to be treated and the names and addresses of owners or lessee(s) of the properties;
   (d) the location of any public bathing areas in the vicinity;
   (e) direction and distance of water movement from the area to be treated;

   (f) access route to the site and compass co-ordinates.

5. Nature of treatment:

Pesticide to be applied

NAME	FORMULATION	ACTIVE INGREDIENT	% ACTIVE	TOTAL QUANTITY

Area or volume of water to be treated:

LENGTH	WIDTH	AVERAGE DEPTH	MAXIMUM DEPTH	VOLUME

Where a stream or river is to be treated for control of blackfly larvae, indicate:

A. VOLUME OF FLOW	or	B. WIDTH	AVERAGE DEPTH	SPEED OF CURRENT (FEET PER MINUTE)

TYPE OF BOTTOM

☐ Sand, ☐ Gravel, ☐ Mud, ☐ Other (Specify)

Concentration of active ingredient in the water not to exceed ..... ppm.

or treatment based on a recommended rate of _____

Method of application

TYPE OF EQUIPMENT		
DATE(S) OF APPLICATION (10 DAY PERIOD)	TIME OF APPLICATION	NUMBER OF APPLICATIONS

6. This permit is a renewal: ☐ NO – ☐ YES –

YEAR(S) OF PREVIOUS PERMITS	PERMIT NUMBER(S)

7. General Information:

Have all adjacent owners or lessees been informed of the proposed treatment and that their use of water may be temporarily restricted? ☐ NO – ☐ YES

Have they all agreed to the proposed treatment? ☐ NO – ☐ YES

Have other persons or organizations who may be affected by the proposed treatment been informed of it? ☐ NO – ☐ YES – WHO

NAME	ADDRESS	TELEPHONE

Is water in the vicinity of the treated area used for:

☐ SWIMMING ☐ IRRIGATION OF CROPS ☐ FISHING (SPECIFY) _____

☐ DRINKING WATER ☐ LIVESTOCK WATERING ☐ OTHER (SPECIFY) _____

Type of sediment

☐ SAND ☐ GRAVEL ☐ MUD OR _____

Other information of value _____

Date ..... 19 .....

Signature of Applicant .....

DO NOT COMPLETE – FOR MINISTRY USE ONLY

Permit No. .....

Permission is hereby granted under the Pesticides Act, 1973 and the Regulations to perform a water extermination

☐ in accordance with the conditions as detailed in the above application
or
☐ with the following amendments

.....

.....

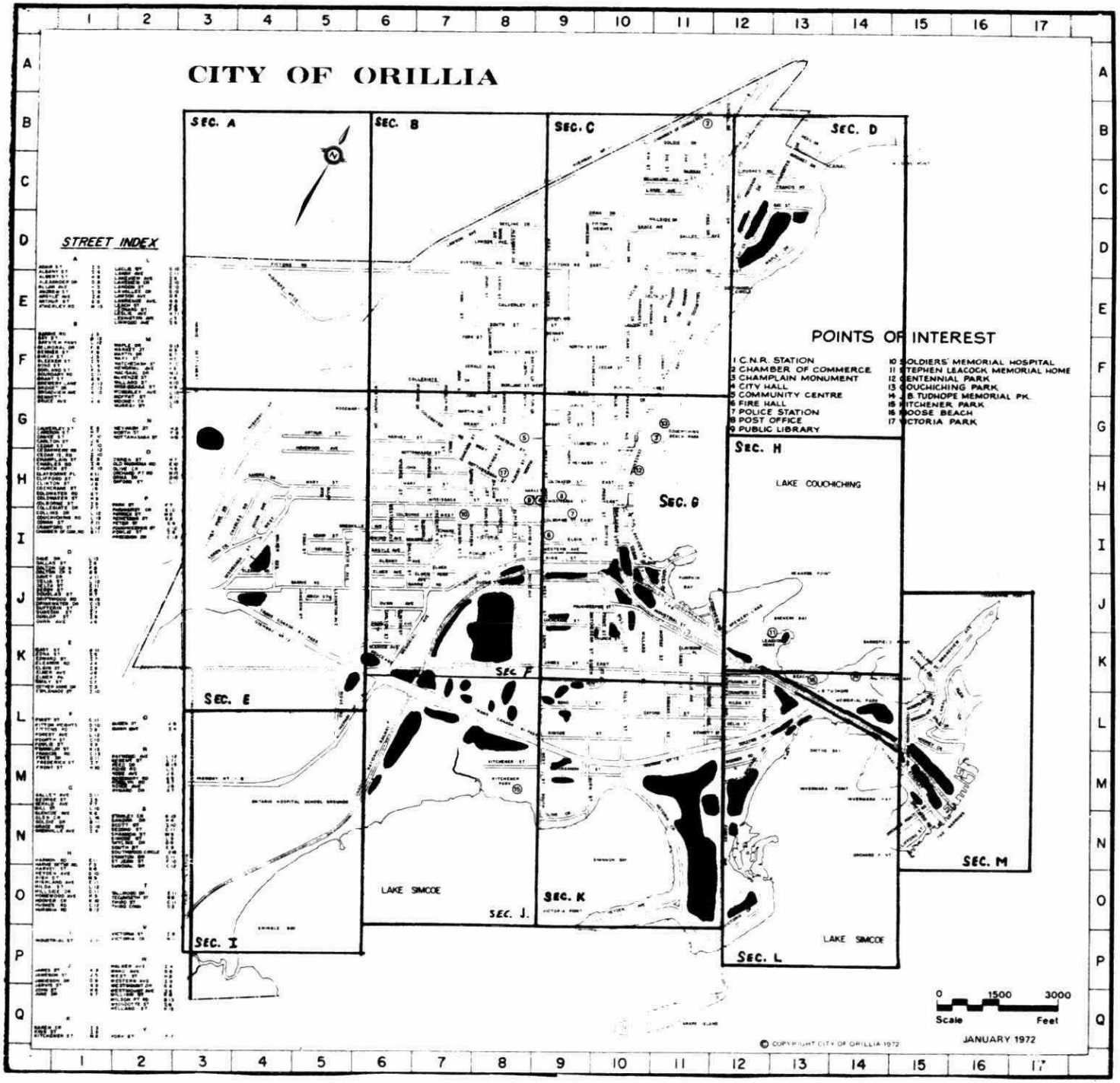
.....

.....

.....

.....

Date ..... 19 ..... Signature of Director .....



APPENDIX III

PROPOSED TREATMENT AREA 1974

675 ACRES

CITY OF ORILLIA

PUBLIC WORKS DEPARTMENT - 1974

MOSQUITO CONTROL PROGRAM

SITE LOCATION

Map Section: _____

Pool No.: _____

Employee: _____

Dates of Larvae Counts	No. of Dips	Average Larvae	Stage of Development	WEATHER CONDITIONS Temp.	Sunny	Cloudy	Wind Speed	Direction

APPENDIX IV

TYPE OF POOL
(Circle Applicable)

Depth ____ins. Shape

Swamp Pool Long

Woodland Pool Narrow

Ditch Round

Wheel Tracks Tiny

Water

Clear Coloured Organic

Bottom

Leaves Grass Mud Clay

Dries Up

Yes No

CHEMICAL TREATMENT

FIRST TREATMENT Date _____

Chemical Used Abate 4E

Dimensions of Pool _____ Area _____

Quantity of Chemical _____

Concentration _____

SECOND TREATMENT Date _____

Chemical Used Abate 4E

Dimensions of Pool _____ Area _____

Quantity of Chemical _____

Concentration _____

RESULTS

FIRST CHECK

Date _____

No. of Dips _____

Larvae Present

Live _____ Dead _____

SECOND CHECK

Date _____

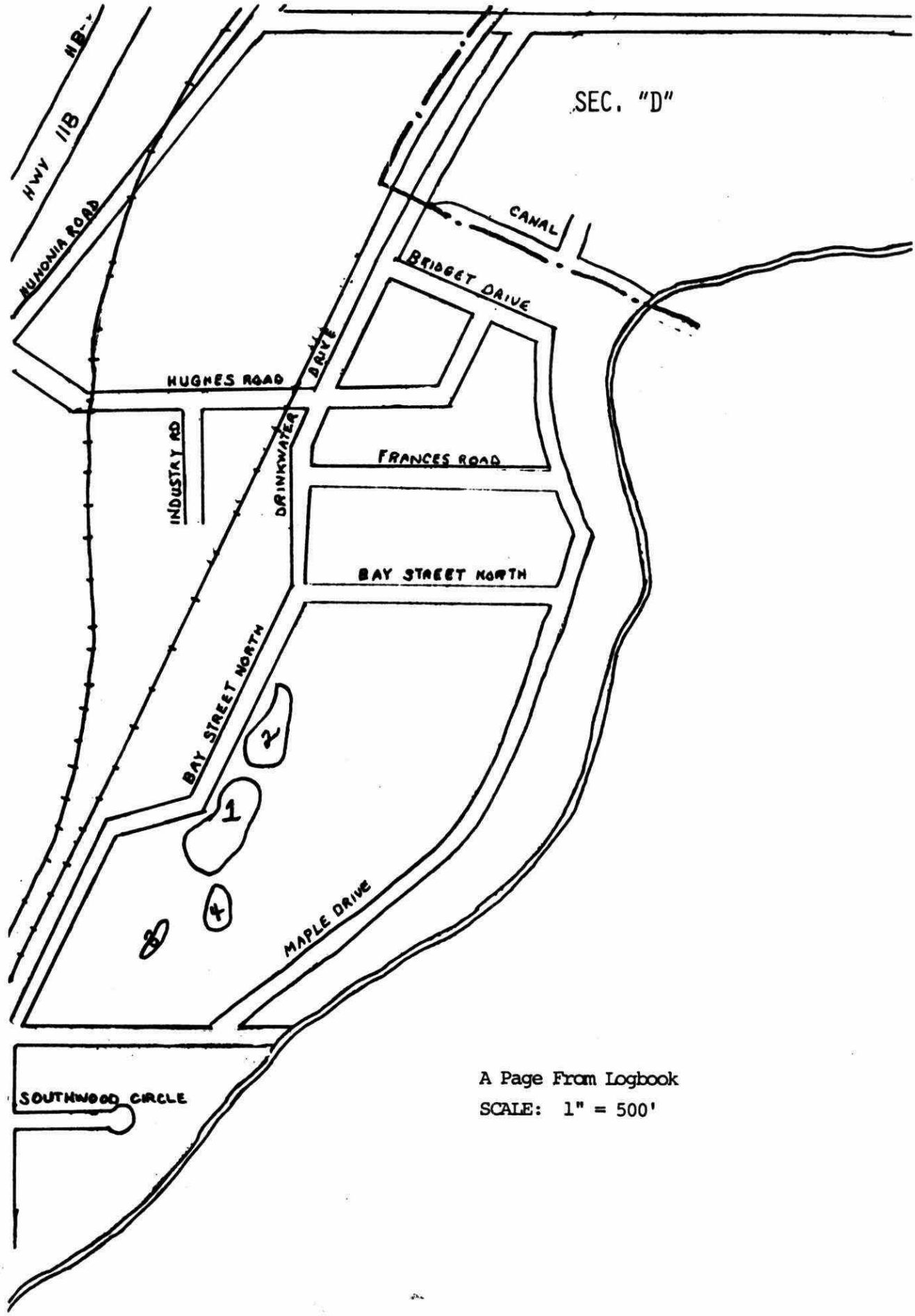
No. of Dips _____

Larvae Present

Live _____ Dead _____

Percent Killed _____

APPENDIX V



A Page From Logbook

SCALE: 1" = 500'

MOSQUITO GENERA OF ONTARIO

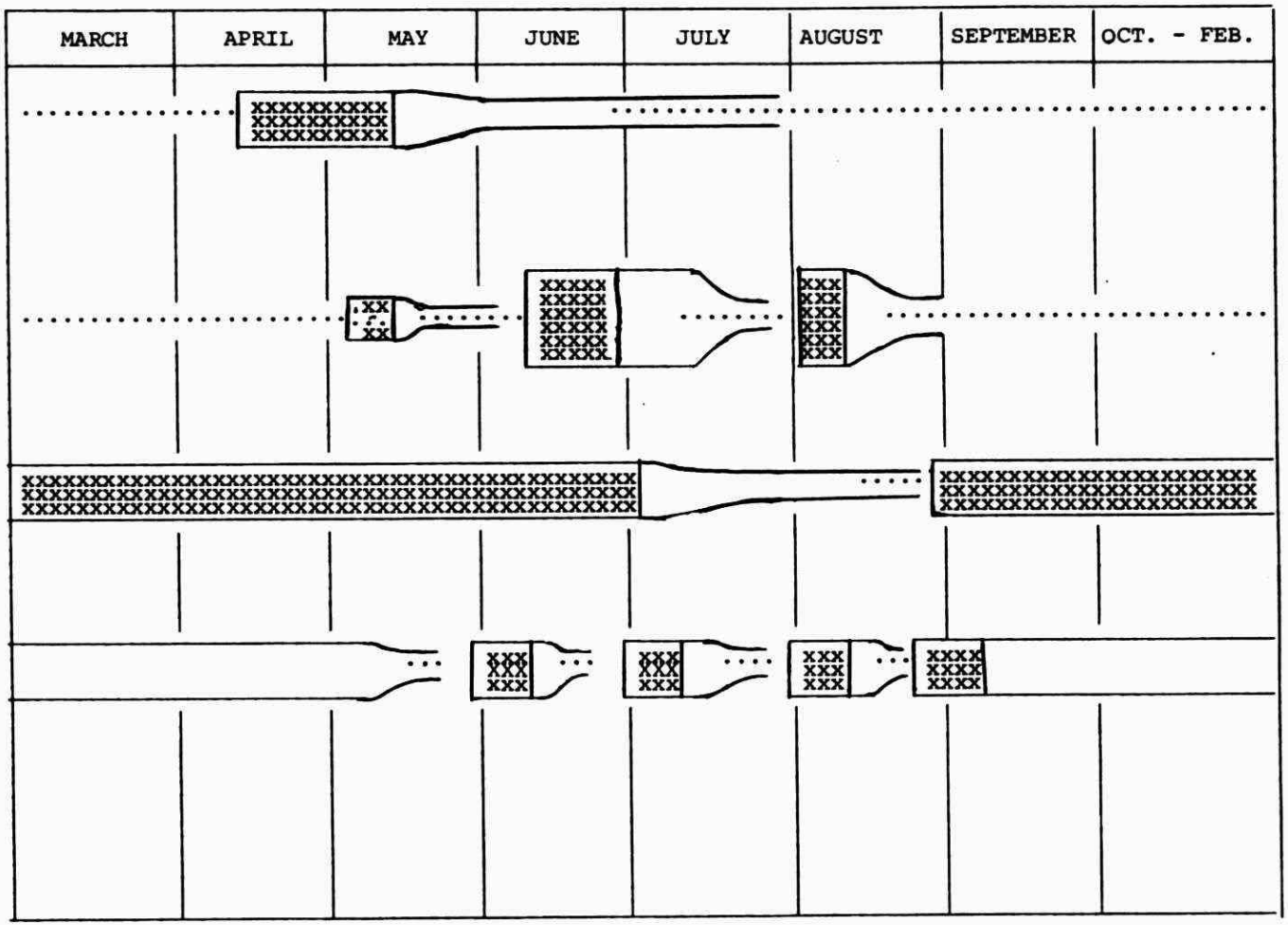
Spring Aedes -
15 species in Ottawa area
Spring melt
- one generation per year

Summer Aedes -
A. vexans + A. sticticus
Flood waters only
- summer rain pools lasting about 5-7 days.
- many generations/year

Mansonia perturbans
(Larvae buried in mud breathing from roots)
Permanent waters
- one generation per year

Culex -
Several summer generations. Adult overwinters.
Permanent waters
Non-biting to humans.

Anopheles.
Some are like Culex, others like Summer Aedes.
-non biting to humans



- Immature stages
- Eggs
- Adults

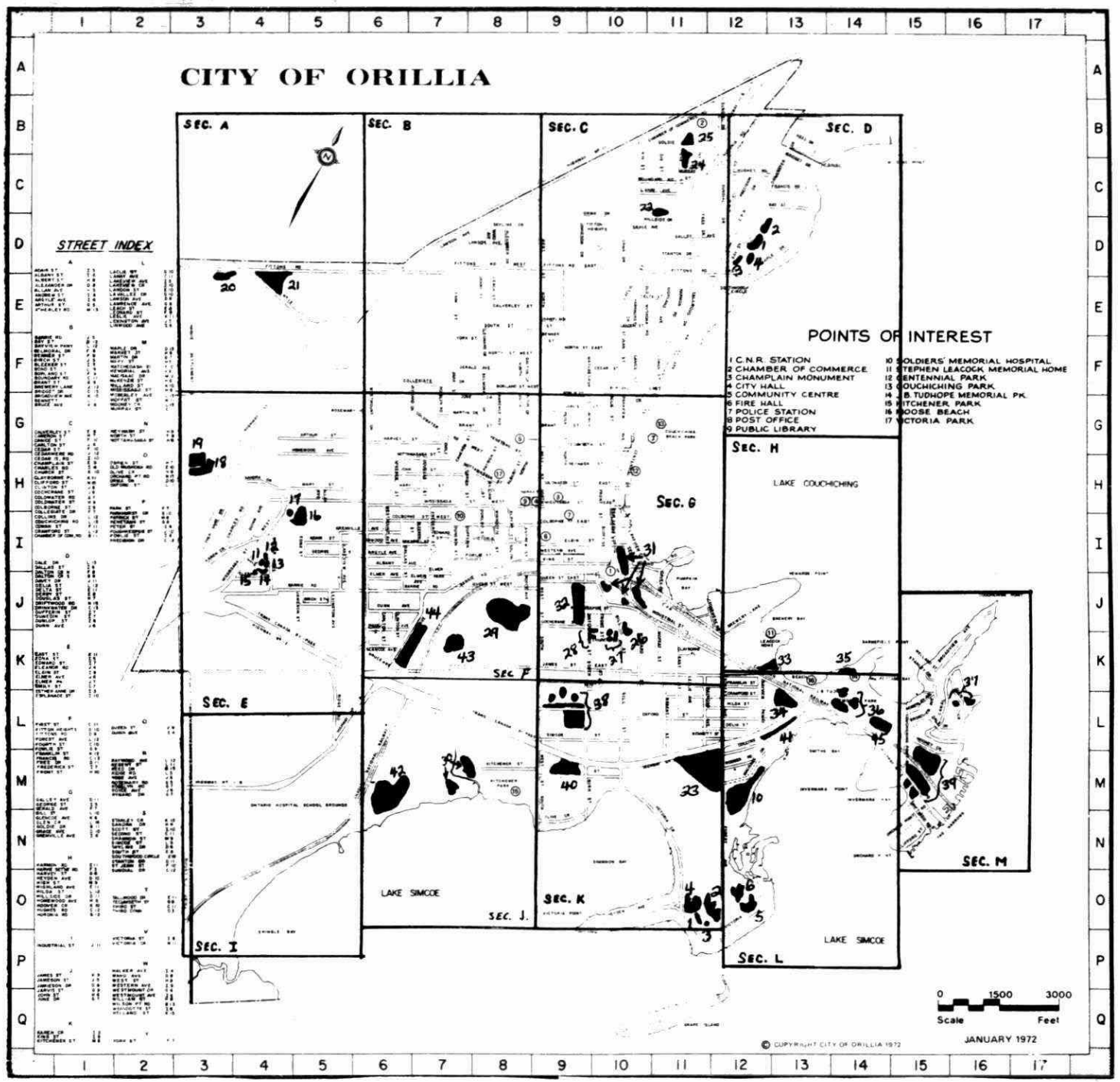
Provided by Dr. M. Wood,
Entomologist with the
Canada Department of Agriculture
Ottawa

APPENDIX VII

USE OF ABATE 4E
ON SMALL POOLS WITH PORTABLE SPRAYER

Pond Diameter (feet)	Area (sq.ft.)	Area (acres)	Total fl. oz. Stock Solution of Abate* Required (1 oz. Abate 4E + 100 oz. Water)
10	78	0.002	0.5
20	314	0.01	2.0
30	706	0.02	4.0
40	1,256	0.03	6.0
50	1,963	0.05	10.0
60	2,826	0.07	14.0

* Resulting rate of Abate product per surface acre is 1.0 fl. oz./A.



APPENDIX VIII
ACTUAL TREATMENT AREA 1974
190 ACRES

APPENDIX IX

CITY OF ORILLIA

MOSQUITO CONTROL REPORT 1974

June 10, 1974.

Mr. E. Foreman, Chairman,
Works & Sanitation Committee

The Mosquito Control Program in the spring of 1974, in the City of Orillia is being carried out under the guidance and authority of the Ministry of the Environment. To do so it has been necessary for me to acquire a Permit to Apply Substances to Water for the Control of Nuisances, a Pesticide Control Operator's Licence, and an Exterminator's Licence Class 3. All of these requirements are necessary according to the Revised Ontario Pesticides Act 1970. The method used previously is no longer allowed, and the Abate "Bombs" are no longer available for commercial use.

Complete records of all treatment have been kept. These consist of maps of pools inspected, numbers of mosquito larvae recorded both before and after treatment, and the quantity of larviciding chemical used. This information must be retained for inspection by the Ministry of the Environment personnel.

The City of Orillia has received extremely good co-operation with the Ministry of the Environment for this Program. A special training course was set up in Toronto for myself to acquire the necessary licences. This included instruction from Dr. Russell Wright, a professor with the University of Guelph. Dr. Wright also made a trip to Orillia to inspect the mosquito habitats and to show us the methods of finding and treating mosquito larvae. He is considered to be the most knowledgeable man on mosquitoes in Canada. Ministry personnel have been in Orillia to take water and soil samples both before and after our treatment. This is done with chemical water pollution in mind. Their time has not cost the City anything.

The methods used are as follows: A visual inspection for larvae is done for each pool of water where the presence of mosquito larvae is suspected. This is done by using a white porcelain water dipper which is dipped in suspect locations and the actual larvae counted and recorded on a separate sheet for each pool. If larvae are present, the size of the pool is estimated and chemical sprayed over it at the rate of approximately one ounce per acre of water of active chemical. After treatment, a follow-up larvae count is taken to record the resultant kill.

SUMMARY

In 1974 we have treated approximately 190 acres of water for mosquito larvae using Abate 2G granular material and Abate 4E emulsion depending on which was easier to apply. Results were about equal for the two forms of material.

The percentage kill of larvae averaged about 95% in treated pools according to our checks. However, with the man-power available and the time consumed, it is difficult to search out and treat every habitat. Treatment must be made at the correct stage of the larvae development in order to get a high rate of kill.

The cost of the 1974 Program has been approximately $4,400 as compared to $3,803 in 1973. This includes the cost of necessary equipment, chemical and expenses in acquiring licences.
Note: We have been advised not to expect a complete wipe out of mosquitoes in the City immediately since they can be driven by wind over considerable distances and it has not been possible in this first year of this Program to locate and treat all hatching areas. However, we are continuing checks and hopefully we can lower the numbers of summer varieties of mosquitoes.

Yours truly,

Elmore Peel,
Superintendent,
Public Works Department.